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SKYLIGHT FLASHINGFIELD OF THE INVENTION

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The present invention relates generally to tubular skylights, and more particularly to roof-mounted flashings.

BACKGROUND

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Tubular skylights have been provided for illuminating rooms inside buildings with natural light. Not only do tubular skylights thus save electricity and, concomitantly, are environmentally benign, but they illuminate rooms in a pleasing way using natural sunlight instead of 60 cycle electric light. An example of a commercially successful tubular skylight is disclosed in U.S. Patent No. 5,099,622, assigned to the same assignee as the present invention and incorporated herein by reference.

A tubular skylight includes a roof-mounted, dome-like transparent cover. The cover is mounted on the roof of a building by means of a flashing. An internally reflective tube depends downwardly from the flashing to the ceiling of the room sought to be illuminated, and the bottom of the tube is covered with a disk-shaped light diffuser that is positioned at the ceiling.

A roof-mounted flashing typically includes a curb, the top of which is covered by the dome and the bottom of which engages a downwardly-depending skylight tube. A flat skirt is typically formed around the bottom of the curb, with the skirt extending radially away from the curb. The skirt is fastened to the roof such that the flashing provides an upper support for the skylight.

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Past methods of making skylight flashings generally require a flat piece of sheet metal to be bent into the desired frusto-conical shape, with the opposed sides of the pieces that meet each other being welded or otherwise fastened together along a seam. Such seams, unfortunately, are unsightly and can fail, allowing dust to enter the skylight and degrade its light transmitting capabilities. Furthermore, the flat skirts, being made of sheet metal, ordinarily are not exceptionally strong. Consequently, the skirts can easily bend, warp, or otherwise become deformed, thereby interfering with the proper engagement of the flashing with a roof. The present invention recognizes the above problems and provides the below-disclosed solutions to one or more of the problems noted herein.

SUMMARY OF THE INVENTION

A tubular skylight includes a seamless flashing. A transparent dome is engaged with the flashing, and at least one skylight tube depends downwardly from the flashing.

In a preferred embodiment, the flashing includes a hollow frusto-conical shaped curb that has an open top which is covered by the dome. Also, the curb defines a bottom periphery opposite the open top, and a skirt extends radially outwardly away from the bottom periphery. In accordance with present principles, the skirt is formed with at least one surface strengthening anomaly such as a rib. More preferably, the skirt is formed with plural radial ribs, and the skirt can also be formed with a peripheral rib that extends along the outer periphery of the skirt.

In another aspect, a roof flashing includes a hollow frusto-conical shaped curb defining a bottom periphery. A skirt extends radially away from the bottom periphery. In accordance with the present invention, the skirt is formed with at least one surface strengthening anomaly.

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In still another aspect, a method for making a flashing includes providing a flat piece of sheet metal, and engaging the sheet metal with a forming die. The forming die is actuated to establish a frusto-conical curb defining a top and a radial skirt extending away from the curb to establish a seamless stock flashing. The method then includes cutting a hole in the top of the curb with the same or another die, and forming at least one rib in the flashing using the same or another die.

In yet another aspect, a method for making a seamless skylight flashing includes forming a seamless stock flashing having a hollow curb that defines first and second ends and a skirt extending radially away from an end. At least one rib is then formed on the skirt. The details of the present invention, both as to its structure and operation, can best be understood in reference to the accompanying drawings, in which like reference numerals refer to like parts, and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of the flashing of the present invention in an exploded relationship with a roof-mounted dome and a skylight tube, with portions of the tube broken away for clarity;

Figure 1A is a cross-sectional view of the peripheral rib as seen along the line 1A-1A in Figure 1;

Figure 1B is a cross-sectional view of a radial rib as seen along the line 1B-1B in Figure 1;

Figure 2 is a perspective view of an alternate flashing having an oblique pitch;

Figure 3 is a flow chart of the present flashing manufacturing process;

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Figure 4 is a cross-sectional diagram of a combined forming and cutting die, with the male part distanced from the female part;

Figure 5 is a cross-sectional diagram of the die shown in Figure 4, with the male part engaged with the female part to form the flashing;

Figure 6 is a cross-sectional diagram of the die shown in Figure 4, with the cutting part advanced to cut the open top end in the flashing; and

Figure 7 is a schematic exploded diagram of a ribbing die.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Figure 1, a tubular skylight is shown, generally designated 10, which includes a roof-mounted flashing 12 that supports a transparent plastic skylight dome 14 above a vertically-oriented internally reflective skylight tube 16 for lighting, with natural sunlight, an interior room in a building. In one embodiment, the dome 14 can be the cover disclosed in U.S. Patent Number 5,896,712 for an invention entitled "LIGHT-COLLECTING SKYLIGHT COVER", owned by the same assignee as the present invention and incorporated herein by reference. Or, the dome 14 can be other suitable covers, such as the covers marketed under the trade name "Solatube" by the present assignee. On the other hand, the skylight tube 16 can be part of the skylight disclosed in the present assignee's U.S. Patent Nos. 5,896,713 or 5,099,622, both of which are incorporated herein by reference, or the tube 16 can be part of other suitable skylights.

As shown in Figure 1, the flashing 12 includes a flat skirt 18 that is attached flush to the roof by means well-known in the art. The skirt 18 defines an outer periphery 20 that, in the preferred

embodiment, is octagonal shaped, it being understood that the periphery 20 can assume other shapes if desired.

A hollow curb 22, preferably frusto-conical shaped as shown, rises upwardly from the skirt 18. The curb 22 can define a right regular conical frustum as shown in Figure 1, or, as shown in Figure 2, a curb 24 of a flashing 26 made in accordance with present principles can define an oblique pitch relative to an associated skirt 28 as appropriate for the cant of a roof to engage and hold the dome 14 in a generally vertically upright orientation. It is to be understood that in all other essential respects the flashings 12, 26 shown in Figures 1 and 2 are identical to each other.

Accordingly, referring back to Figure 1, the present curb 22 defines an open top end 30 that is covered by the dome 14 and an open bottom end 32 that is opposed to the top end 30. It can readily be appreciated in reference to Figure 1 that the curb 22 defines a vertical axis 34, and that the skirt 18 blends into and extends outwardly away from the bottom end 32 in a radial dimension that is orthogonal to the axis 34. Owing to the below-described manufacturing process, at least the curb 22 and preferably also the skirt 18 are seamless.

Figure 1 shows that the skirt 18 is formed with plural elongated strengthening ribs. More specifically, the skirt 18 is formed with plural elongated radial ribs 36 that are oriented radially on the skirt 18. Also, in the preferred embodiment a peripheral rib 38 is formed on the periphery 20 of the skirt 18. We have found that for optimum stiffening, the peripheral rib 38 should be formed as shown, i.e., on the extreme outer periphery of the skirt 18, with no portions of the skirt 18 extending radially outwardly beyond the peripheral rib 38. The ribs 36, 38 shown herein are examples of surface strengthening anomalies.

Figure 1A shows that the skirt 18 defines an upper surface 40 and a lower surface 42, and that the peripheral rib 38 can rise above the upper surface 40. Or, the peripheral rib 38 can extend below the lower surface 42 of the skirt 18. In either case, the peripheral rib 38 can be thicker than the skirt 18. Alternatively, as shown the peripheral rib 38 can have the same thickness as the skirt 18 and be trough-shaped, as is the case with the radial ribs 36.

Indeed, turning now to Figure 1B, as shown each radial rib 36 can be formed as a trough-like structure that rises in a curve above the upper surface 40 of the skirt 18. It is to be understood that depending on whether the male part of the ribbing die disclosed below has rib-forming flutes, or the female part of the ribbing die has rib-forming flutes, the radial ribs 36 could alternatively be formed as trough-like structures that dip below the lower surface 42 of the skirt 18. Stated differently, each radial rib has a concave surface and an opposed convex surface, and the concave surface can be contiguous to the upper surface 40 of the skirt 18 with the convex surface being contiguous to the lower surface 42, or vice-versa. In either case, the thickness of each radial rib 36 can be equal to the thickness of the skirt 18.

Figure 3 shows the manufacturing process of the present invention. Commencing at block 44, a piece of flat stock sheet metal is provided. Such a piece is shown in Figure 4 and designated 46. Next, at block 48 the piece 46 is positioned under a female part 50 of a combined forming and cutting die, generally designated 52. The female part 50 preferably has the shape of the curb that is desired to be formed from the piece 46. As can best be appreciated in reference to Figure 5, a male part 56, preferably having the shape of the curb that is desired to be formed from the piece 46, is pressed into the piece 46 to form a stock flashing as shown further below.

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In the preferred embodiment, two separate dies are used, it being understood that a single die could be constructed having plural male parts as appropriate to undertake the method shown herein. Or, more than two dies can be used. When two dies are used, however, a male cutting part 58 that is centrally located with respect to the male part 56 is advanced into the stock 46 to form the open top end 30 (Figure 1) of the flashing, as indicated at block 64 in Figure 3.

Once the open top end has been formed, the stock flashing is removed from the combined forming and cutting die 52 at block 70 of Figure 3 and engaged with a ribbing die, generally designated 72 and shown in Figure 7. The ribbing die 72 includes a male part 74 that is advanced upwardly against the stock flashing, which is held by a female part 76. Either the male part 74 can be formed with ribbing features 78 as shown to form the ribs 36, 38 of the flashing 12 shown in Figure 1, or the female part 76 can be formed with convex or concave flutes to form the ribs 36, 38, or both parts 74, 76 can be formed with flutes. In any case, at block 82 the male part 74 is pressed onto the stock flashing, which is sandwiched between the male and female parts 74, 76, to press-form the ribs 36, 38 on the skirt 18 (Figure 1).

While the particular SKYLIGHT FLASHING as herein shown and described in detail is fully capable of attaining the above-described objects of the invention, it is to be understood that it is the presently preferred embodiment of the present invention and is thus representative of the subject matter which is broadly contemplated by the present invention, that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly to be limited by nothing other than the appended claims, in which reference to an element in the singular is not intended to mean "one

and only one" unless explicitly so stated, but rather "one or more". All structural and functional equivalents to the elements of the above-described preferred embodiment that are known or later come to be known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the present claims. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed by the present claims. Furthermore, no element, component, or method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. No claim element herein is to be construed under the provisions of 35 U.S.C. §112, sixth paragraph, unless the element is expressly recited using the phrase "means for".